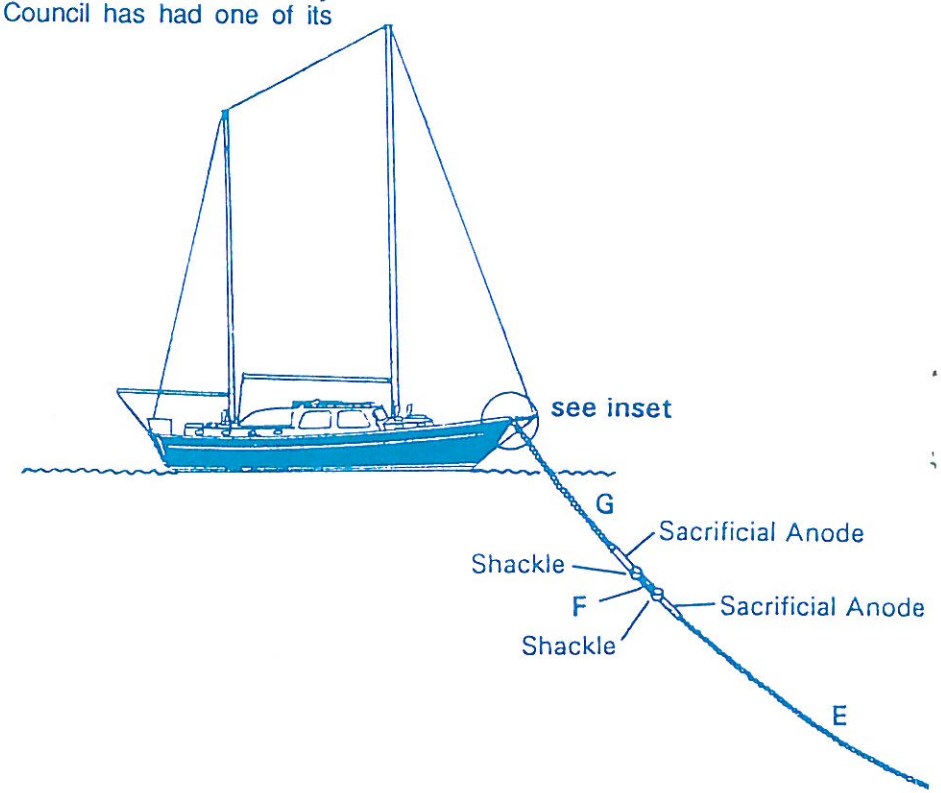
Swing Moorings - A New Standard

The Canterbury Regional Council is responsible for the statutory requirements covering navigation and safety in Lyttelton Harbour. As part of this function, the Council provides and administers mooring sites for swing moorings. The minimum standards for swing moorings have been reviewed and a new specification issued as at June 1991.

The provision for swing moorings in Lyttelton increases the number of areas where boats can moor and therefore the total number of mooring spaces. It also provides a cheaper, but equally secure mooring place to boat owners.

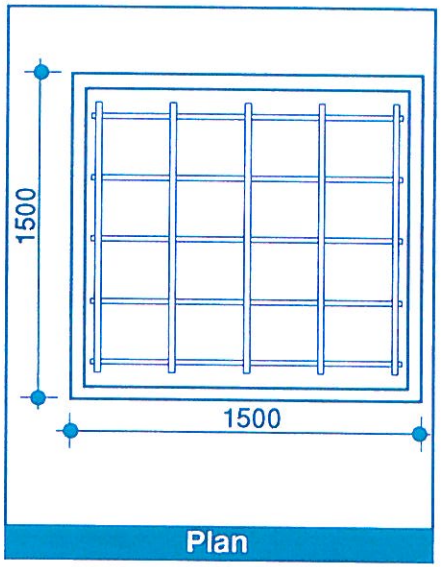
To maintain this level of security and price advantage the Canterbury Regional Council has had one of its engineers design a new mooring block and provide a new standard of mooring and tackle system.

While these mooring blocks may be a bit heavier than some presently used, in storm conditions it is not weight alone which provides security. Moving of the block results from a combination of uplift and horizontal forces (ground chain becoming taut), liquefaction of ground conditions (wave action), and loss of suction (combinations of wave action and chain tension). The effects are countered more by the surface area of the block than by mass. This is the reason for opting for two blocks in the case of highest displacement vessels permitted to moor.

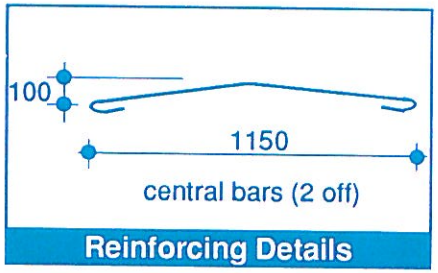


1800 kg Reinforced Concrete Mooring Block

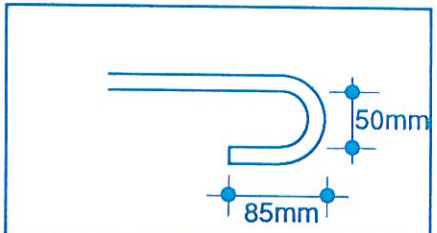
Rod Reinforcing Method



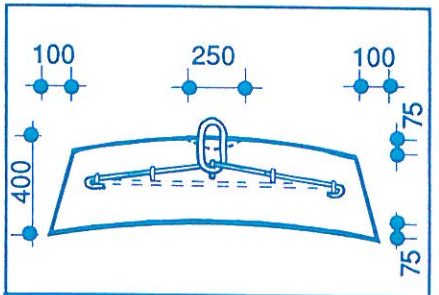
Plan



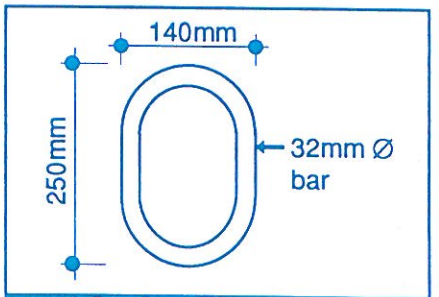
Reinforcing Details



Hook Detail



Cross Section



Anchor Ring Detail

Details

All reinforcing is made from 12mm deformed bar.

There are ten 1150mm long bars at 250mm centres.

The two centre bars are bent as shown, with the four outer bars being straight.

The four intermediate bars are bent to suit.

Minimum cover is 75mm.

The top and bottom surfaces are curved as shown, with a 250mm diameter depression, 50mm deep, hollowed out on the upper surface around the anchor ring.

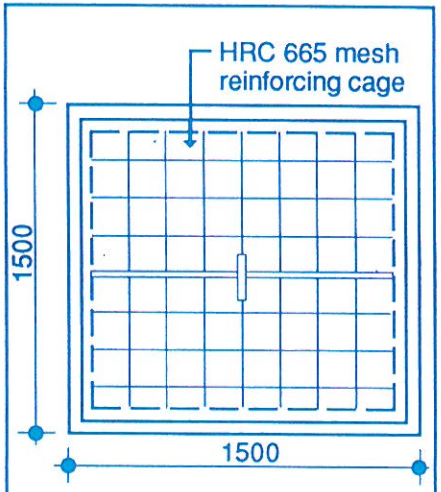
The anchor ring should protrude 100mm from the concrete.

All the dimensions for the 1200kg block are the same except:

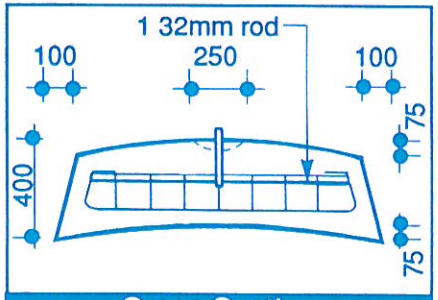
- The base of the block is reduced to 1.28 m^2.
- The reinforcing bars should be 950mm long instead of 1150mm.
- They should be at 225mm centres.
- Extra care should be taken to make sure minimum cover is maintained

1800 kg Reinforced Concrete Mooring Block

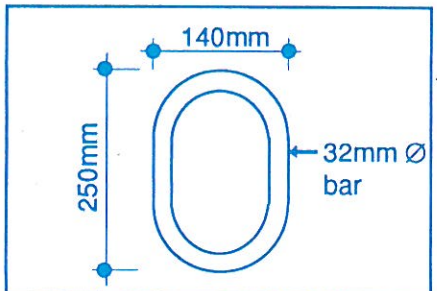
HRC Reinforcing Mesh Method



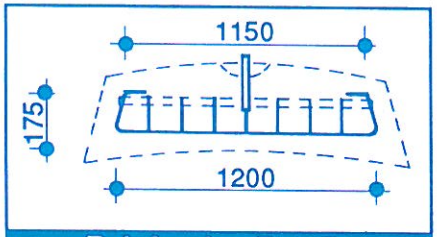
Plan



Cross Section



Anchor Ring Detail



Reinforcing Details

Details

A cage with a 1200mm square base is formed using HRC 665 mesh.

A 32mm diameter, 1150mm long deformed steel bar passes through the anchor ring and through the mesh at each side.

Minimum cover is 75mm.

The top and bottom surfaces are curved as shown, with a 250mm diameter depression, 50mm deep, hollowed out on the upper surface around the anchor ring.

The anchor ring should protrude 100mm from the concrete.

All the dimensions for the 1200kg block are the same except:

- The base of the block is reduced to 1.28 m^2.
- The 32mm reinforcing bar should be 950mm long instead of 1150mm.
- The reinforcing cage should have a 1000mm square base, a 940mm square top and be 175mm high.
- Extra care should be taken to make sure minimum cover is maintained

CANTERBURY REGIONAL COUNCIL

58 Kilmore Street, PO Box 345,
Christchurch
Telephone (03) 653 828

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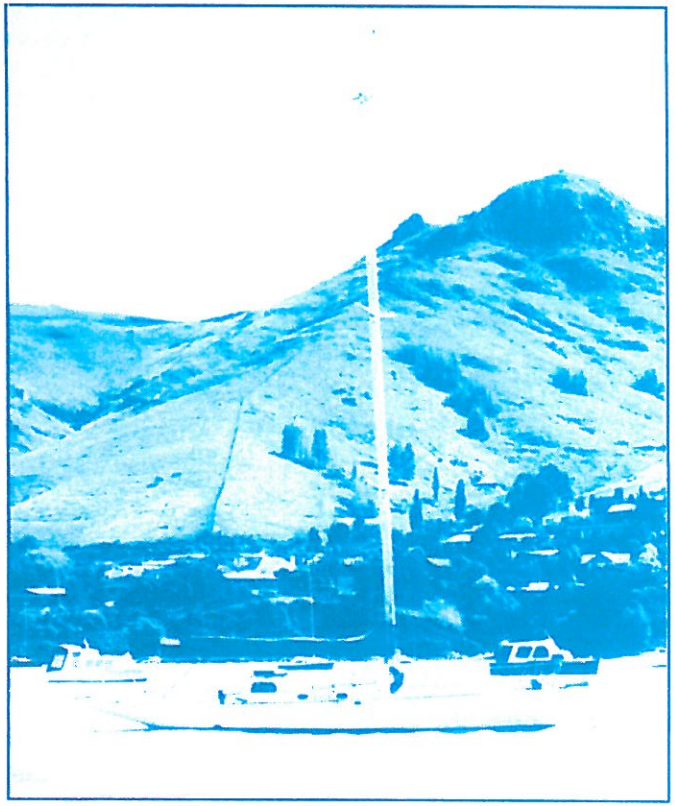
Swing Moorings

- a new standard -



CANTERBURY REGIONAL COUNCIL

The bottom conditions in Lyttelton are principally marine silts but in some areas mixed particle size sand. In these conditions the surface area of the block as stated above is very important. However, it is expected that the block will sink into the bottom material, expelling air and liquid as it does. Liquid silts will soon fill the space adjacent to the slope sides of the block effectively keying it into the bottom material. This situation increases holding and decreases the block profile, reducing the prospects of it being hit by keels of other boats or being snagged.

The sloping of the sides of the block has three beneficial effects: firstly it assists keying into the bottom material, secondly it reduces snagging, and thirdly in conditions where the ground chain tension is very high it will assist the block to rotate about the bottom edge causing the block to dig in (like the flukes of an anchor) and increase its sectional area in the direction of the load.

The domed top of the block has two beneficial effects; it reduces chances of snagging and adds mass to the block. A depression in the centre of the block for the mooring ring also reduces the chance of snagging and should reduce wear on the ring and principal shackle by restricting relative movement.

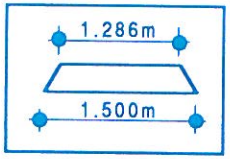
Mooring tackle has been designed to provide the appropriately sized components consistent with the need to reduce the effects of corrosion and wear. Corrosion effects can be significantly reduced by providing zinc sacrificial anodes to the chains as shown on the drawings. The security of the mooring system is the responsibility of the boat owner. The best insurance against failure is to provide components required in the drawings.

It is recommended that inspection of the tackle, to remove kinks and replace worn components, be carried out at six monthly intervals. The whole mooring system should be thoroughly inspected annually.

To Construct a Mooring Block

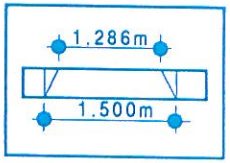
1800 kg Block

- Form four sides of mould with 12mm construction ply or 25 mm thick timber. Construct two sides of the mould so that the framework is shaped like the base segment of a triangle e.g.

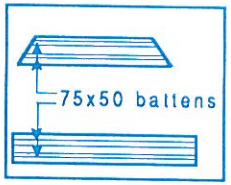


with the longest side 1.5m and the shorter side 1.286m and the width 414mm. The second two sides should be the same width but cut to approximately 1.6m long.

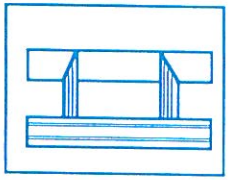
- Then mark lines at right angles to edge across face of planks 1.5 metres apart. Measure 142mm inwards from lines on one edge. Mark from lines 1.5m apart on one edge to marks on other edge 1.286m apart. These lines give the 75° inclination of edge of block.



- Nail 2 parallel 75 x 50 battens along planks 150mm either side of centre line and trim ends off battens to sloped edge. Nail together into sloped edge of formwork and ends of cut battens to form base of hollow truncated pyramid. Nail triangular fillet, 30 mm wide, into corners of mould. Oil inside pyramid with used engine oil.



- Before placing steel or concrete, select flat area preferably concrete slab and cover with Tarpaulin, newsprint, or similar. In centre of cover place quantity of sand, builders mix or similar in 1.5 metre square sided heap to maximum height of 80mm. Cover mound of aggregate with polythene film. This will form a hollow depression in base of block.



If constructing mooring block with HRC mesh cage:

Place cage centrally on heap supported on bits of concrete not less than 0.075m cubes. Carefully lift formwork over the HRC mesh and adjust to exceed minimum cover all round. Tie in 30 ø reinforcing rod carrying mooring ring to HRC mesh cage.

If constructing mooring block with 12 ø reinforcing steel:

Place formwork centrally over covered heap of sand or mix as above. Tie reinforcing steel including mooring ring so that a rigid mesh is formed.

- Arrange for inspection of formwork and steel reinforcing by CRC Inspector prior to placing of concrete.

For the rod reinforced alternative:

Place concrete into mould until reinforcing cage sits with the edge rods approximately 80mm below the upper edge of the mould.

- In both alternatives, begin to fill mould with concrete, agitating wet concrete with vibrator or reinforcing rod as filling takes place. When concrete is up to top of mould, place a heap of wet concrete over about 1/2 the area of the top of the mooring block, to just cover the mooring ring. Work concrete from centre of block out towards edges with steel float or steel trowel. Form to shape shown on drawings.

- After depression is formed around mooring ring, wipe mooring ring clean of concrete material. A personal identification mark i.e. initials and date should be inscribed in depression.

- As soon as concrete has hardened keep surface moist. Strip formwork from block 24 hours after placing concrete. Cover block with sisal bags or coir matting and keep moist for a further 3 days.

- Two weeks after casting, arrange for block to be taken to Lyttelton Port Company weigh bridge to be weighed. The weighbridge certificate should then be presented at the Harbour Master's office, Lyttelton Port Company, Lyttelton prior to the block being laid.

1200 Kg Block

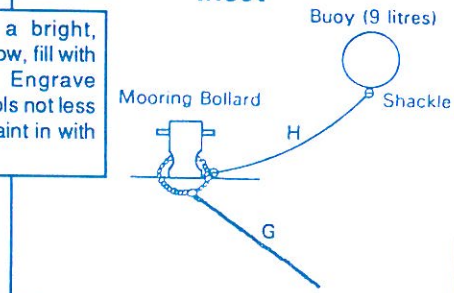
- A similar construction method applies but the base side is 1.280m, so replace 1.5m by 1.280m. Approximate distance 1.6 should be reduced to 1.3 and 1.286m reduced to .996.

		MOORING										
		A	B	C		D	E		F	G		H
Disp. of Vessel (tonnes)	Approx Length of Vessel at Water Line	Mooring Block	Shackle or Ring	Ground Chain		Hammer-lock Shackle or Ring	Chain		Swivel Optional	Chain or Rope		Buoy Rope
			Min Bar Size	L	Diam (mm)	Diam (mm)	L	Diam (mm)	Diam (mm)	L	Diam (mm)	
Over 20t	Over 12m	2 of 1800kg		4.5m	38	38	Approx 1.5 Depth of High Water	16	25	To Suit Vessel	16 if Chain or Equiv Strength Rope	1 x 19 S'less Steel Wire
7-20t	8-12m	1800kg	32	4.5m	32	38		16	25			
Under	Under	1200kg		4.0m	20	25		12	20			

For vessels over 20t displacement, two 1800kg blocks should be coupled with 4m 32mm chain. Ground chain C shall then be shackled at the mid point of the coupling chain with a similar shackle to the one at D.

Inset

Your buoy must be a bright, reflecting colour. If hollow, fill with polystyrene beads. Engrave number on top in symbols not less than 30mm high and paint in with contrasting colour.



Sacrificial anodes must be bolted to the chain in locations shown for cathodic protection.

Where shackle is used at B, shackle pin internal thread shall be drilled out and pin replaced by mild steel bolt and nut. The protruding end of the thread shall be drilled at right angles and seized by split pin or mild steel wire.